DOCUMENT RESUME

ED 173 859 CS 205 024

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TITLE Prospects for Technical Communication: Research for Futures Needs.
PUB DATE Apr 79
NOTE 11p.; Paper presented at the Annual Meeting of the Conference on College Composition and Communication (30th, Minneapolis, Minnesota, April 5-7, 1979)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Communication (Thought Transfer); *Communications; *Futures (of Society); Models; *Organizational Communication; *Research Needs; Technical Reports; *Technical Writing; Technological Advancement

ABSTRACT

The need for technical communication to enable the transition from a "postindustrial" future to an alternative future is incalculable; however, research is required to improve current technical communication models and methods. The current rhetoric of technical communication derives from an inadequate command-generated technical communication model, which provides no criteria by which the technical communicator can make basic rhetorical decisions. Research questions cannot be asked until an effective technical communication model, which introduces the dynamic factors within and without an organization that affect the technical communication process, has been developed and tested. Once developed, the model can guide research. Technical communication for the future will need to establish and maintain viable relationships between the spheres of technology and production and of social services and political institutions. The communication situation associated with the environmental impact statement illustrates the need for new technical communication strategies and methods. In addition, both types of transition studies that are conducted--studies of the behavior of systems, and studies of persons in roles within those systems--suggest a number of research opportunities and needs in technical communication. (GT)

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PROSPECTS FOR TECHNICAL COMMUNICATION
Research For Futures Needs

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Technical communication will be essential in a post-industrial society and for an effective transition to such a society. However, current technical communication practices are inadequate. Research to improve current technical communication models and methods therefore is required. Research to develop new rhetorics of technical communication for the future and for the transition also is required.

The 20th century has been called the century of transition from civilized to post-civilized society.[1] Science and technology are considered the basis for the transition because their methods and products effect social change and because the values systems and world views associated with science and technology encourage change and development. The post-civilized society being created has been characterized by many commentators, and the characteristics of a "post-industrial" society are envisioned to include a complex technological infrastructure, a highly developed service sector infrastructure, a complex centralized hierarchy of social institutions, and global interdependencies.[2]

The central role of technical communications in such a society cannot be questioned. Scientific and technological development and innovation will require exponential growth in technical communication--electronic, oral, written--in order for this society to function efficiently and effectively. The development of a service sector society will depend on technical communication. The increasing complexity of economic-political-social institutions will function only through effective technical communication. Growing global interdependencies will require technical communication if they are to be effectively interdependent.

Technical communication also will be essential for an effective transition to such a society. Although conjecture about the form of the future is interesting in itself, it assumes purpose because the anticipated form of the future helps us identify the problems of transition. Crisis studies, such as John Platt's "What We Must Do,"[3] and transition studies, such as Mihajlo Mesarovic's and Edward Pestel's Mankind at the Turning Point,[4] identify necessary actions and "necessary changes" in order for social institutions to develop, change, and adapt appropriately. Cursory analysis indicates that technical communication will be an essential factor in those "necessary actions and changes."

* This paper was presented at the 1979 Conference on College Composition and Communication, Minneapolis, Minnesota, April 5, 1979.

CS205024

In discussing the role communication will play in the post-industrial society and in the transition to a post-industrial society I am assuming that forms of technical communication will be essential. In making this assumption I do not mean to imply that traditional public discourse will not be necessary, although this rhetoric also must be developed to meet these challenges. Some of the most important challenges of the future, as well as of transition to the future, involve the need to preserve public participation and community as our society engages in on-going discussion and problem-solving.[5] But we also must be aware of a complementary need to improve the quality of technical communication. The rhetorical situations facing technical communication are and will be more complex, more structured, and more dynamic than those facing public discourse.

The current state-of-the-art in technical communication, however, is inadequate to meet these present and future needs. Research into the theory and practice of technical communication therefore is necessary. Research also is necessary to develop and test appropriate technical communication models.

Current Technical Communication Methods And Models Are Inadequate

My colleague W. Earl Britton characterizes technical writing as "functional writing," and argues that this type of writing is central to most affairs of modern life.[6] He is fond of explaining functional writing by quoting from G. B. Harrison, the distinguished Shakespearian scholar, in his *Profession of English:*

> The most effective elementary training I ever received was not from masters at school but in composing daily orders and instructions as staff captain in charge of the administration of seventy-two miscellaneous military units. It is far easier to discuss Hamlet's complexes than to write orders which ensure that five working parties from five different units arrive at the right place at the right time equipped with proper tools for the job. One soon learns that the most seemingly simple statement can bear two meanings and that when instructions are misunderstood the fault usually lies with the wording of the original order.

This operational definition of technical writing applies to much technical writing today, and much technical communication education is implicit in its premises.

This definition of technical communication, however, assumes a static, organized, indeed mechanistic world. Notice that the military metaphor assumes that the goals of the activity are clear and indisputable. It assumes that the problems addressed are clearly defined. It assumes that the values involved (e.g., efficiency) are unambiguous and indisputable. It assumes that the map is known--paths of activity and behavior are

known or can be calculated. And it assumes that the roles of all the persons involved are clear and known. This indeed often is the role of the technical communicator--and most persons--in modern organizations.

Our current rhetoric of technical communication derives from this model. The goals of the company provide a framework for explaining the technical issue; the criteria for explaining and solving the company's problem are clear, and usually involve cost-efficiency-reliability trade-offs. The audiences for a report can be identified, arranged hierarchically or prioritized, and their values and attitudes determined. Company policies provide the norms and standard procedures provide the communication map.

Delineation of this model suggests that it is inadequate. The professional/report writer responds to an assignment (a "command"), performs

Figure 1. Command-generated technical communication model.

an analysis, writes a report, sends it out, and action ensues, as illustrated in Figure 1. Such a model assumes that everything is a "given" to the report writer; it provides no space for rhetorical invention, analysis, and evaluation on the part of the report writer. It creates a "fill-in-the-blank," "describe how a pencil sharpener works" attitude toward technical communication. It provides no suggestion that the technical communicator must: (1) analyze the implications of the assignment to determine the goals and criteria of his or her technical task; (2) determine the purpose of the report, that is, the various persuasive and informational implications of the results and conclusions of the investigation; (3) identify and analyze the audiences, and anticipate their reactions; (4) choose when to describe, when to analyze, when to explain, etc., and what details to select. The model provides no criteria by which the technical communicator can make basic rhetorical decisions. The model treats the technical communicator (the technician, professional, etc.) as an automaton.

The New York Times recently had an article about a cost overrun by The Long Island Lighting Company of some 500%--approximately a $1.05 billion overrun.[7] The New York State Public Service Commission is investigating "mismanagement." The problem seems to be G. B. Harrison's: ensuring "that five working parties from five different units arrive at the right place at the right time equipped with the proper tools to do the job." The "most severe problems have been with pipefitters," as studies show that they spend 20% of their 7-hour day actually working, 40% waiting for tools and directions, 13% in on-site travel, etc. The consulting engineering firm, it turns out, had recommended that this

pipefitting company not be used, but the Light Company had ignored the recommendation. The command-generated technical communication model did not work when applied by the pipefitting company, and by the consulting engineering firm as well.

An immediate research need therefore is to analyze actual technical communication situations to identify all of the rhetorical decisions that should enter into report writing. Success and failure usually are due to fundamental rhetorical problems. The problems often involve the contextual factors that affect technical communication, which stem from role differences within organizations, between organizations and professions, and between organizations and public communities and constituencies.

Research questions therefore cannot be asked until an effective technical communication model has been developed and tested. The model must introduce the dynamic factors within the organization as well as outside the organization that affect the technical communication process, as illustrated in Figure 2.8 Whereas the current approach is to treat a report as a thing-in-itself, a tool to perform an act, a model that identifies some of the factors that go into a report indicates that a report is part of a complex technical communication process that persists over time. An adequate model first must be developed.

Once developed, the model can guide research. A model will indicate research into any number of factors, such as how an efficient distribution list is designed and how company protocol on report audiences and report writers as well as report formats inhibits or facilitates communication in different types of technical communication situations. Almost any empirical investigation into technical communication practices will indicate inefficiencies and failures due to demonstrably ineffective rhetorical conventions and decisions. Given our increasing awareness of the social context of technical communication, an appropriate systems model will enable the researcher to search for the sources of inefficiencies and failures beyond as well as within the organizations themselves. A test report recommendation, for example, may fail to be implemented because the writer failed to translate a conclusion into a recommendation or because of ineffective audience analysis or report transmission. The test report recommendation, however, might fail to be implemented because the test report technical communication network does not include the organizational components interfacing with government agencies and public sector agencies, and aware of current litigation practices and legislation.

A survey of current technical communication needs and problems therefore suggests that much research is needed in order to meet present needs as well as to provide the basis necessary to address future needs.

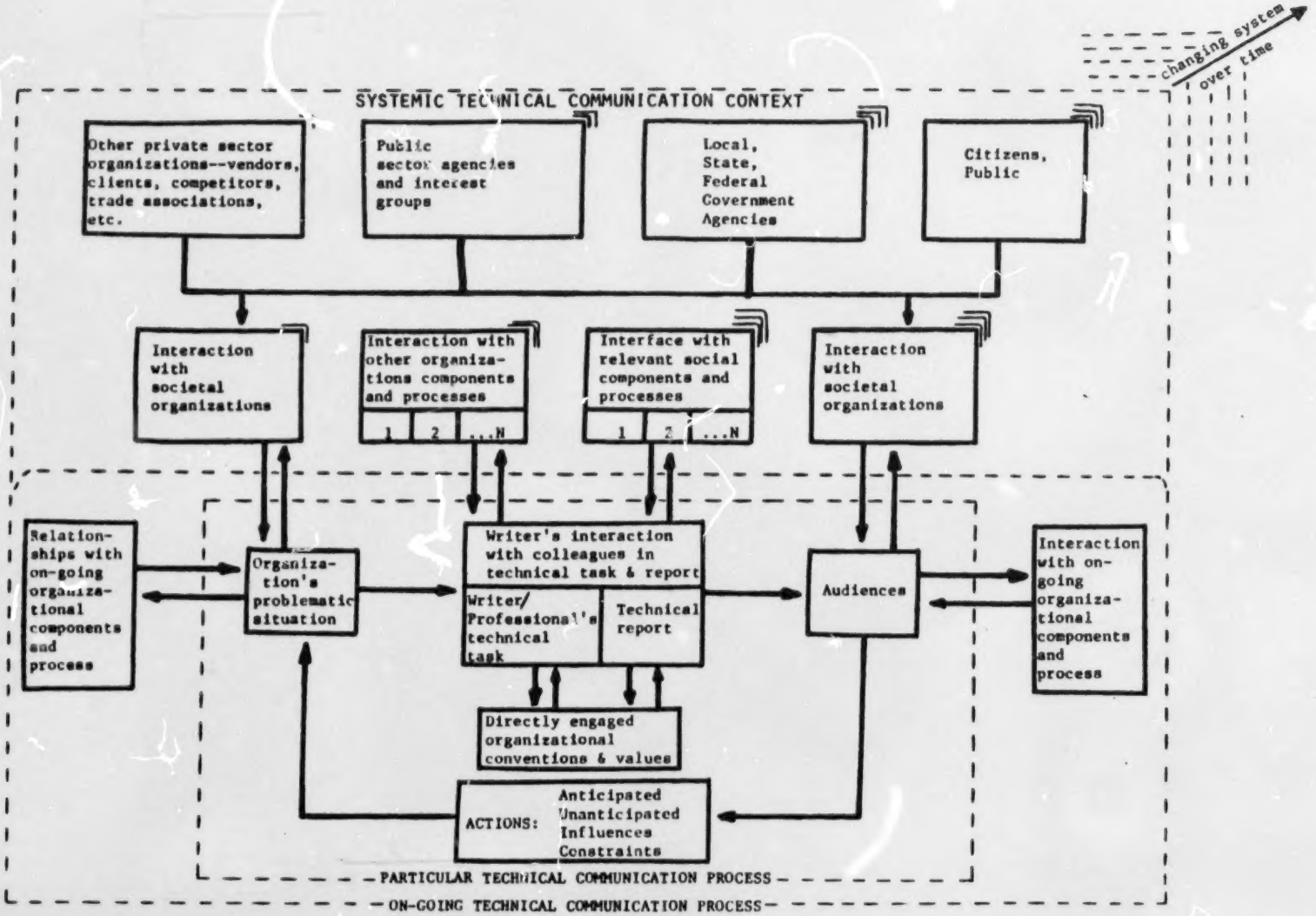
changing system over time
SYSTEMIC TECHNICAL COMMUNICATION CONTEXT
Other private sector organizations--vendors, clients, competitors, trade associations, etc.
Public sector agencies and interest groups
Local, State, Federal Government Agencies
Citizens, Public
Interaction with societal organizations
Interaction with other organizations components and processes
1 2 ...N
Interface with relevant social components and processes
1 2 ...N
Interaction with societal organizations
Relationships with on-going organizational components and process
Organization's problematic situation
Writer's interaction with colleagues in technical task & report
Writer/Professional's technical task
Technical report
Audiences
Interaction with on-going organizational components and process
Directly engaged organizational conventions & values
ACTIONS:
Anticipated
Unanticipated
Influences
Constraints
PARTICULAR TECHNICAL COMMUNICATION PROCESS
ON-GOING TECHNICAL COMMUNICATION PROCESS

Figure 2. The Technical Communication Process In A Systemic Context

Technical Communication For The Future

The post-industrial society has been described as a predominantly service-sector society, but such a society will require a highly sophisticated technological and production infrastructure to function successfully. That is, the service sector, public and private, will consist of numerous agencies and processes which will depend on the technology and productivity of numerous private and perhaps public organizations. The technological communication needs in such a society will be to establish and maintain viable relationships between the spheres of technology and production and the spheres of social services and political institutions.

Some technical communication, of course, will be associated with electronic technologies. Technical communication in part will become automated, and much research is needed to establish effective and appropriate communication in computer and other technology modes. Persons are actively exploring such areas as information retrieval, computer conferencing, and cable telecommunication, but much remains to be done in each of these areas. A proposed computerized information sharing network on Social Impact Assessment, for example, envisions a "Bulletin Board" accessible to all participants, individual correspondence files, papers for commentary to be appended, and monthly conferences.[9] This technological advance, as you can see, embodies no advance in technical communication or rhetorical techniques. Yet such an advance should be complemented by basic rhetorical innovation encompassing the technical communication situation and the opportunities presented as well as specific innovation in technical communication techniques and formats.

Much technical communication, however, will remain basically discursive. Research is needed to change technical communication from a linear process into a hierarchical, open-ended feedback process if socially viable relationships between technology and society are to be established. Test reports now are written as though they are part of a linear communication process involving engineering design, production, and marketing cost/efficiency tradeoffs. As these test reports become evidence in litigation, certain anti-communication techniques are being devised to maintain this linear technical communication process. This tactic, however, will become increasingly inefficient and counter-productive. Such linear processes will not be acceptable in a post-industrial society, either within an organization or to other agencies and organizations. New technical communication strategies and methods therefore are required.

The environmental impact report communication situation is particularly illustrative of the need. The environmental impact statement is a form of technical communication by which consultants communicate to clients in industry and the appropriate regulatory agencies, primarily for the AEC regulatory staff. The current technical communication situation of the environmental impact statement, however, does not provide for all relevant groups, especially public sector groups and constituencies, to be involved at a meaningful stage of the communica-

tion process.[10] The statements, of course, invariably conclude that "The benefits to be derived...outweigh the adverse effects identified in this statement."[11] Because of an ineffectively established technical communication situation, the environmental impact statement often can fail to reach its communication objectives. The Midland Michigan nuclear plant, originally scheduled to be completed in 1974 for $267 million, due to litigation and controversy still is not completed; projected costs now are near $1 billion. Part of the problem is that the environmental impact statement was conceived as a form of adversary communication on a quasi-judicial model.[12]

The problem with the environmental impact statement seems to be analogous to the most important technical communication problems of the future in almost every area, if the post-industrial society develops as envisioned by most commentators. Almost all social processes to a significant extent will depend upon role-structured communications between organizations and units. New technological communication models and practices will be required to meet this need, and basic and applied research is required to develop them.

Technical Communication For The Transition

Perhaps the most important technical communication needs already are present, for the present is a stage of transition toward an as yet unrealized future. The technical communication research required to help our social institutions evolve into the future is implicit in every study of transition problems. These studies can be divided into two types, studies of the behavior of organizations and systems, and studies of persons in roles within those systems.

Analyses of the behavior of systems seldom mention "technical communication," and when they mention communication at all it is an axiomatic rather than analytic reference. Yet almost all of the problems such studies address have significant technical communication aspects. John Platt discusses "certain self-reinforcing 'lock-in situations' which represent the most dangerous situations in the world today."[13] Platt discusses a number of possible solutions, but interestingly does not discuss an immediately obvious leverage point, the technical communication processes in those situations.

Technical communicators can analyze the "lock-in situations" of organizational systems in terms of the technical communication factors in those situations. The technical communication practices within and between organizations "lock-in" the organization even as they facilitate the various processes within the organizations. A distribution list can reinforce inefficient hierarchical decision-making procedures in an organization; a test report procedure can embody unresponsive attitude and value systems within an organization; the annual report format can reinforce a counter-intuitive image of an organization. Evaluation of technical communication practices with the objective of improving an organization's ability to adapt seems an important research need in this

period of accelerating need for change.

Analyses of the behavior of persons in organizational roles invariably address communication needs and technical communication needs. An important analysis of the need for organizational change, by Donald N. Michael, argues that persons in organizations must develop different patterns of organizational behavior if they and their organizations are to be "future-responsive." This "will require basic changes in the ways people view themselves and others, and basic changes in the norms and structures of organizations that facilitate and reward some behaviors and punish others. To be able to learn them will also require changes in the way members of the environment view themselves and the organizations that serve them."[14] Michael's analysis has implications for interpersonal communication, for public discourse, and especially for technical communication.

If an organization is to be future-responsive, the decision-making and communication processes must change significantly. Current technical communication procedures in organizations are incompatible with the needs for the professionals in those organizations to function under conditions of uncertainty, expectations of error, changes and conflicts in goals and criteria, and role ambiguity, to use Michael's terms. Michael observes "that it makes a profound difference whether one shares one's uncertainty or whether one acts in ways that mislead people into believing that one really knows the risks involved. It affects what is expected, how arguments are conducted, what is concentrated on, and what feedback can be tolerated."[15] Michael's analysis directly addresses technical communication practices. For example, in reports themselves it calls into question the way in which the organizational problems, needs, and tasks are stated, as well as the criteria for making and evaluating conclusions and recommendations. It additionally calls into question methods of selection and arrangement of material, as uncertainty or certainty over risks involved would lead to quite different report content and design. It fundamentally calls into question technical communication procedures designed to reaffirm roles, hierarchies, lines of authority, unit boundaries, etc.--technical communication as taught and practiced today. All but the most routine technical communication situations must be redefined if professionals in organizations are to be future-responsive.

Transition studies therefore suggest an indefinite number of research opportunities and needs in technical communication. Organizations and professionals must change and adapt as our society becomes increasingly complex and our resources increasingly limited. Technical communication practices and principles at present, however, may inhibit more than facilitate effective change and adaptation. At the same time effective change and adaptation will depend on the development of new and appropriate technical communication techniques. Technical communication therefore will be both part of the problem and part of the solution.

My analysis assumes evolution toward a post-industrial society where organizations and interactions between organizations will predominate. I have neglected to consider alternative futures. But to the extent that anyone anticipates an alternative future, especially one to be created by design, additional research opportunities present themselves. And the transition requirements to shift toward an alternative future indicate numerous research needs. Gregory Bateson, for example, discusses "ecology and flexibility in urban civilization" if our civilization is to survive.[16] It may be that in most of the alternative futures we envision, especially those embodying an ecological model, technical communication will be subordinate to the public discourse necessary to maintain the participatory social organizations required. But such societies will depend on alternative technologies and alternative social organizations, and therefore will depend on innovative technical communication techniques as well.

The need for technical communication to enable the transition from a post-industrial future to an alternative future, however, is incalculable. Without effective technical communication during the transition, there may be no future at all.

References and Notes

[1]Kenneth E. Boulding, *The Meaning of the Twentieth Century*, New York: Harper and Row, 1965.

[2]Daniel Bell, ed., *Toward the Year 2000: Work in Progress*, Boston: Beacon, 1969, pp. 1-8.

[3]John Platt, "What We Must Do," *Science*, 28 November 1969, pp. 1115-1121.

[4]Mihajlo Mesarovic and Edward Pestel, *Mankind at the Turning Point*, New York: E. P. Dutton, 1974. The quote is on p. 5.

[5]Lloyd F. Bitzer and Edwin Black, eds., *The Prospect of Rhetoric*, Englewood Cliffs, NJ: Prentice-Hall, 1971. This project develops the paradigm for the necessary research in this area.

[6]W. Earl Britton, "Technical Reporting," *On Writing, By Writers*, William H. West, ed., Boston: Ginn, 1966, pp. 335-337.

[7]Frances Cerra, "P.S.C. Unit Asks An Investigation of a Lilco Plant," *New York Times*, March 7, 1979, pp. B1, B5.

[8]This model is meant to indicate open-ended, systemic, dynamic factors not presented in our basically linear model in J. C. Mathes and Dwight W. Stevenson, *Designing Technical Reports*, Indianapolis: Bobbs-Merrill, 1976, p. 7.

[9]Personal communication from David K. Miller, director of Project IMPRESS, February 20, 1978.

[10]James P. Zappen analyzes the rhetoric of the environmental impact statement, and develops an alternative rhetoric. His "Nonadversary Communication Models for Environmental Decision Making" (mimeograph, Department of Humanities) provides an excellent outline of the problem and suggests a solution.

[11]Steven Ebbin and Raphael Kasper, *Citizen Groups and the Nuclear Power Controversy: Uses of Scientific and Technological Information*, Cambridge, Mass.: MIT Press, 1974, p. 239. They present two case studies and an extensive analysis of the communication problems.

[12]Parallel to Zappen's analysis, I address this problem in a social decision analysis context in a research project, "A Study of Value-Oriented Decision Analysis" (with Kan Chen), NSF Grant OSS77-16294, 1 January 1978-31 August 1979.

[13]John Platt, "Shaping the Evolutionary Future," *Perception and Change*, Ann Arbor: University of Michigan Press, 1970, pp. 142-148.

[14]Donald N. Michael, *On Learning to Plan--and Planning to Learn*, San Francisco: Jossey-Bass, 1973, p. 18.

[15]Michael, pp. 128-129; in general, refer to "Part Two" for discussion of the behavior of persons in organizations.

[16]Gregory Bateson, *Steps to an Ecology of Mind*, New York: Ballentine, 1972, pp. 494-505.